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C-reactive Protein Levels as A Predictor of Difficult Laparoscopic Cholecystectomy

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Author`s Contribution

[1,3]Substantial contributions to the conception or design of the work; or the acquisition, Drafting the work or revising it critically for important intellectual content Final approval of the study to be published ,[2,4,5]Active participation in active methodology, Statistical analysis.

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ABSTRACT

Objective: To determine the mean C-reactive protein (CRP) levels preoperatively among patient with Acute Cholecystitis to predict difficulty of Laparoscopic Cholecystectomy on Nassar Grade.

Methodology: This cross-sectional study was conducted in General Surgery Department, PAEC General Hospital, Islamabad from 30/01/2023 to 31/07/2023 This study was conducted in the Department of General Surgery, PAEC General Hospital, Islamabad. 150 patients having symptomatic gallstones were enrolled in the study. CRP level was determined preoperatively in all patients. All patients underwent LC. Intraoperative difficulty level was determined using the Nassar grade. Mean CRP level was compared between the 5 grades Nasser scale, by applying ANOVA test keeping p-value ≤ 0.05 as significant.

Results: A total of 150 patients with symptomatic gallstones were enrolled for the study. The mean age of the patients was 47.29+/-13.75 years. 34 (22.7%) were male and 116 (77.3%) were female. The mean WBC count of our patients was 9075.27+/-3437.46/µL. The mean CRP level of our patients was 31.01+/-61.32 mg/dL. The mean CRP level was significantly higher in patients with grade 4, followed by grade 3, grade 2 and grade 1 (p-value < 0.01).

Conclusion: Our study concluded that there is a significant link between higher CRP levels and increased Nassar grades, indicating a positive relationship between elevated CRP levels and greater intraoperative difficulty during LC.

Keywords: Cholelithiasis, Acute cholecystitis, Laparoscopic cholecystectomy, Nassar grade.

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Introduction

Gall stones is one the most common cause of hospital admission, it effects 15% of adult population of Western countries and its incidence in children and adolescent are increasing, risk factor include smoking, diabetes, hypertension, sedentary lifestyle.[1] Intestinal bacteria are one of the major causes of gall stone formation.[2] Gall stone diseases is asymptomatic in majority of the patient.[3]

Acute Cholecystitis is the inflammation of gallbladder which occur due to gallstones obstructing neck of gallbladder causing inflammation resulting in increases WBC and CRP level.[4,5,6] CRP is acute phase protein whose level in within 6 hrs of inflammation and level drops as the inflammation subsides, CRP of more than 6mg/dl is considered significant in acute cholecystitis.[6,7]

Diagnostic criteria and severity grading of acute cholecystitis is based on Tokyo Guidelines 2007. Guidelines are put together studying local clinical signs, Systemic signs of inflammation and Imaging studies of patient with acute cholecystitis. Patient who are suspected of having acute cholecystitis have one Local Sign and one Systemic sign.[8,9] Early laparoscopic cholecystectomy is preferred over delayed as there is lower morbidity rates and decreased risk of conversion to open cholecystectomy.[10,11] Nassar operative difficulty scale contains 5 criteria of difficult laparoscopic cholecystectomy.[12]

The aim of this study is to measure the preoperative CRP levels to identify the patients at risk for a difficult laparoscopic cholecystectomy and hence necessary safety measures are taken by the surgeon to reduce the intraoperative complications and postoperative morbidity.

Methodology

Cross- sectional Study was conducted in PAEC General Hospital Islamabad from January 2023 to July 2023. The study was approved by the Ethical Review Board of PAEC General Hospital. Patient of age 17 -70 undergoing laparoscopic cholecystectomy were included in our study, Exclusion criteria included patient having Acute Hepatitis, Biliary Pancreatitis, Chest & Urinary Infection or other acute abdominal diseases. The sample size of 150 was calculated using WHO sample size calculator formula 7.1.[13] Non-probability consecutive sampling technique used. Patients admitted in General Surgery ward of PAEC General Hospital Islamabad were recruited according to the selection criteria after obtaining written, informed consent. A thorough history and examination were performed for all patients. Examination was performed prior to the administration of analgesics (which could mask tenderness) and antipyretics (which could cause mask fever), Laboratory tests (WBC count and CRP) were performed at PAEC General Hospital Laboratory and the relevant findings were recorded in the data collection form. Laparoscopic Cholecystectomy was performed by a consultant general surgeon at PAEC General Hospital. Nasser grade will be assigned intraoperatively.

Data were analyzed with statistical analysis program (IBM-SPSS version 22). Mean and standard deviation were calculated for quantitative variables like age and CRP levels. Frequency and percentage were calculated for qualitative variable like gender, Nassar Scale, raised WBC, and type of imaging. Mean CRP level was stratified over effect modifiers like age, gender, raised WBC and type of imaging. Mean CRP level was compared between the 5 grades Nasser scale, by applying ANOVA test keeping p-value ≤ 0.05 as significant.

Results

A total of 150 patients with symptomatic gallstones were enrolled for the study. The mean age of the patients was 47.29 +/- 13.75 years with an age range of 18-70 years. Gender distribution of the patients showed that 34 (22.7%) were male and 116 (77.3%) were female. The mean WBC count of our patients was 9075.27 +/- 3437.46/µL with range of 1450-21300/µL. 103 (68.7%) patients had WBC count < 10,000/µL whereas 47(31.3%) had WBC count > 10,000/µL.

The mean CRP level of our patients was 31.01 +/- 61.32 mg/dL with a range of 0.6-415.7 mg/dL. 48(32.0%) had Nassar grade 1 intraoperative difficulty, 46(30.7%) had grade 2, 44(29.3%) had grade 3 whereas 12(8.0%) had grade 4 intraoperative difficulties.

Stratification of mean CRP level over gender showed that the mean CRP level was high in males than in females, however the difference was statistically insignificant (40.98 +/- 76.47 vs 28.09 +/- 56.18, p-vale 0.283). Stratification of mean CRP level over age groups showed that the mean CRP level was significantly higher in patients having age > 50 years. Mean CRP level was similar in patients with WBC count < 10,000/µL and those with WBC count > 10,000/µL. Comparison of mean CRP level between the 5 grades of Nassar scale showed that the mean CRP level was higher significantly higher in patients with grade 4, followed by grade 3, grade 2 and grade 1 with a p-value of < 0.01.

Table I: Comparison of Mean CRP level between the grades of Nassar Scale.

		CRP Level	
Nassar Scale	N	Mean	Std. Deviation
Grade 1	48	5.829	7.6938
Grade 2	46	11.322	10.4583
Grade 3	44	50.545	69.2814
Grade 4	12	135.625	116.6879
Total	150	31.014	61.3203

Discussion

In this study, we aimed to investigate the relationship between CRP levels, and intraoperative difficulty assessed by Nassar scale, in patients undergoing LC for symptomatic gallstones. Our findings provide valuable insights into the potential impact of pre-operative CRP level on the intraoperative difficulty during LC. We found a significant link between higher CRP levels and increased Nassar grades, indicating a positive relationship between elevated CRP levels and greater intraoperative difficulty during laparoscopic cholecystectomy.

The demographic characteristics of the study population revealed that the mean age of the patients was 47.29 +/- 13.75 years, with a wide age range of 18 to 70 years. Older age > 60 years, has been linked to conversion to open from LC.[14] However, we did not encounter any conversion to open cholecystectomy. This could be attributed to the fact that majority of our patients were < 50 years old.

Gender distribution showed that females constituted a higher proportion (77.3%) of the study population compared to males (22.7%). These gender differences in gallstone prevalence are consistent with previous research, where females have been shown to have a higher risk of developing symptomatic gallstones compared to males.[15-18]

We assessed the mean WBC count in our patient cohort, which was found to be 9075.27 +/- 3437.46/µL. Further stratification based on WBC count revealed that 68.7% of patients had a WBC count < 10,000/µL, while 31.3% had a WBC count > 10,000/µL. Elevated WBC count has been shown to predict the absence or presence of gangrenous cholecystitis. Teefey et al. demonstrated that increased gallbladder wall thickness on ultrasound along with elevated WBC count were associated with gangrenous cholecystitis.[19]

Evaluation of CRP levels demonstrated a mean value of 31.01 +/- 61.32 mg/dL among the study participants. In our analysis, we observed that patients older than 50 years had significantly higher CRP levels compared to younger patients. However, there was no statistically significant difference in CRP levels between males and females.

Assessing intraoperative difficulty, we utilized the Nassar scale and classified patients into five grades. We found that a higher proportion of patients experienced moderate to severe intraoperative difficulty, with 29.3% classified as grade 3 and 8.0% as grade 4. The association between CRP levels and the Nassar scale grades revealed a significant correlation, with higher CRP levels observed in patients with higher grades of intraoperative difficulty. Our study results are consistent with Ng et al. who performed 804 emergency LC. They demonstrated a significant correlation between CRP concentration and Nassar grade, the mean preoperative peak CRP level was 64.7% mg/l for operational difficulty grade I, 69.6% mg/l with grade II, 98.2% mg/l for grade III, 217.5% mg/l for grade IV, and 193.1% mg/l for grade V.[20]

Our study has several implications for clinical practice and future research. The observed association between higher CRP levels and greater intraoperative difficulty suggests that CRP may serve as a potential predictive marker for assessing the complexity of gallstone surgeries. Further studies are needed to validate this finding and determine its clinical utility.

Limitations of our study should be acknowledged. Firstly, the study design was cross-sectional, which limits our ability to establish causal relationships. Secondly, the sample size was relatively small, and the study was conducted at a single center, which may affect the generalizability of our findings. Therefore, larger multi-center studies are warranted to confirm our results and ensure their applicability to a broader population.

Conclusion

Our study concluded that there is a significant link between higher CRP levels and increased Nassar grades, indicating a positive relationship between elevated CRP levels and greater intraoperative difficulty during laparoscopic cholecystectomy.

These findings suggest that CRP, as a marker of systemic inflammation, could potentially serve as a useful predictive factor for assessing the likelihood of encountering intraoperative challenges. Patients with higher CRP levels may require closer monitoring and careful preoperative planning to mitigate potential complications during surgical procedures. Our study provides compelling evidence of a positive link between CRP levels and intraoperative difficulty assessed using the Nassar Scale. These findings highlight the clinical significance of CRP as a potential predictive marker and emphasize the importance of incorporating inflammation-related parameters into preoperative assessments and surgical planning processes.

References

1. Di Ciaula A, Portincasa P. Recent advances in understanding and managing cholesterol gallstones. F1000Res [Internet]. 2018 [cited 2023 Jan 6];7:1529. Available from: http://dx.doi.org/10.12688/f1000research.15505.1
2. Grigor'eva IN, Romanova TI. Gallstone Disease and Microbiome. Microorganisms. 2020;8(6):835. https://doi.org/10.3390/microorganisms8060835
3. Thangavelu A, Rosenbaum S, Thangavelu D. Timing of Cholecystectomy in Acute Cholecystitis. J Emerg Med. 2018;54(6):892-897. https://doi.org/10.1016/j.jemermed.2018.02.045
4. Jones MW, Genova R, O'Rourke MC. Acute Cholecystitis. [Updated 2022 Oct 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459171.
5. van Dijk A, Wennmacker S, de Reuver P, Latenstein C, Buyne O, Donkervoort S et al. Restrictive strategy versus usual care for cholecystectomy in patients with gallstones and abdominal pain (SECURE): a multicentre, randomised, parallel-arm, non-inferiority trial. The Lancet. 2019;393(10188):2322-2330. https://doi.org/10.1016/S0140-6736(19)30941-9
6. Bouassida M, Zribi S, Krimi B, Laamiri G, Mroua B, Slama H et al. C-reactive Protein Is the Best Biomarker to Predict Advanced Acute Cholecystitis and Conversion to Open Surgery. A Prospective

Cohort Study of 556 Cases. J Gastrointest Surg. 2019;24(12):2766-2772. https://doi.org/10.1007/s11605-019-04459-8

7. Arora BS, Sen P, Singh RK, Biswal I, Paruthy SB. hsCRP levels as predictor of difficult laparoscopic cholecystectomy- current status evaluation experience in a teaching institution. Int Surg J 2017;4:1345-9 https://doi.org/10.18203/2349-2902.isj20171139
8. Yokoe M, Hata J, Takada T, Strasberg SM, Asbun HJ, Wakabayashi G, et al. Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholecystitis (with videos). J Hepatobiliary Pancreat Sci. 2018;25(1):41-54. https://doi.org/10.1002/jhbp.515
9. Takada T. Tokyo Guidelines 2018: updated Tokyo Guidelines for the management of acute cholangitis/acute cholecystitis. J Hepatobiliary Pancreat Sci. 2018;25(1):1-2 https://doi.org/10.1002/jhbp.526
10. Serban D, Socea B, Balasescu SA, Badiu CD, Tudor C, Dascalu AM et al. Safety of Laparoscopic Cholecystectomy for Acute Cholecystitis in the Elderly: A Multivariate Analysis of Risk Factors for Intra and Postoperative Complications. Medicina (Kaunas). 2021;57(3):230. https://doi.org/10.3390/medicina57030230
11. Rice C, Vaishnavi K, Chao C, Jupiter D, Schaeffer A, Jenson W et al. Operative complications and economic outcomes of cholecystectomy for acute cholecystitis. World J Gastroenterol. 2019;25(48):6916-6927. https://doi.org/10.3748/wjg.v25.i48.6916
12. Griffiths E, Hodson J, Vohra R, Marriott P, Katbeh T, Zino S, et al. Utilisation of an operative difficulty grading scale for laparoscopic cholecystectomy. Surg Endos. 2019; 33:110-21. https://doi.org/10.1007/s00464-018-6281-2
13. Who.int. 2023. Available from: https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/steps/sample-size-calculator.xls?sfvrsn=ee1f4ae8_2
14. Simopoulos C, Botaitis S, Polychronidis A, Tripsianis G, Karayiannakis AJ. Risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy. Surg Endosc. 2005;19(7):905-9. https://doi.org/10.1007/s00464-004-2197-0
15. Everhart JE, Khare M, Hill M, Maurer KR. Prevalence and ethnic differences in gallbladder disease in the United States. Gastroenterology. 1999;117(3):632-9. https://doi.org/10.1016/S0016-5085(99)70456-7
16. Everhart JE, Yeh F, Lee ET, Hill MC, Fabsitz R, Howard BV et al. Prevalence of gallbladder disease in American Indian populations: findings from the Strong Heart Study. Hepatology. 2002;35(6):1507-12. https://doi.org/10.1053/jhep.2002.33336
17. Racine A, Bijon A, Fournier A, Mesrine S, Clavel-Chapelon F, Carbonnel F et al. Menopausal hormone therapy and risk of cholecystectomy: a prospective study based on the French E3N cohort. Can Med Assoc J. 2013;185(7):555-61. https://doi.org/10.1503/cmaj.121490
18. Singh V, Trikha B, Nain C, Singh K, Bose S. Epidemiology of gallstone disease in Chandigarh: a community-based study. J Gastroenterol Hepatol. 2001;16(5):560-3. https://doi.org/10.1046/j.1440-1746.2001.02484.x
19. Teefey SA, Dahiya N, Middleton WD, Bajaj S, Dahiya N, Ylagan L et al. Acute cholecystitis: do sonographic findings and WBC count predict gangrenous changes?. Am J Roentgenol. 2013;200(2):363-9. https://doi.org/10.2214/AJR.12.8956
20. Ng HJ, Ahmed Z, Khan KS, Katbeh T, Nassar AHM. C-reactive protein level as a predictor of difficult emergency laparoscopic cholecystectomy. BJS Open. 2019;3(5):641-45. https://doi.org/10.1002/bjs5.50189